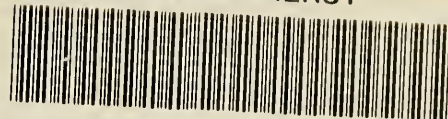


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LAWS RELATING TO THE PREVENTION OF RIVER POLLUTION IN MASSACHUSETTS.

X. H. GOODNOUGH,
Chief Engineer, State Board of Health.

Read before the Sanitary Engineering Section, American Public Health Association, Colorado Springs,
September, 1913.

In response to requests from members of the Association, I present here-
with a brief description of the legislation of the state of Massachusetts
relating to the prevention of the pollution of streams, the authority of the
State Board of Health under existing laws and a general statement of the
results accomplished in the enforcement of these laws.

In the consideration of these questions, it is of course not intended to
discuss the question of the pollution of streams so far as it may affect their
use as sources of domestic water supply. The use of unpurified river
waters for domestic water supply in Massachusetts was discontinued long
ago in accordance with recommendations of the State Board of Health,
and in only one or two instances are river waters used for domestic purposes
in Massachusetts, even after purification. The question considered herein
is the problem of the prevention of the pollution of streams from the point
of view of the health and comfort of those dwelling along their banks or
in their neighborhood.

HISTORY.

Interest in the question of stream pollution in Massachusetts was very
probably first aroused by the agitation of this question in England, and
the first studies of the general condition of Massachusetts streams were
made by the State Board of Health in the early 70's. Apparently the first
legislation of importance relative to a study of the question of the condi-
tion of streams was enacted by the General Court in 1875. The important
portions of this act are as follows:

. . . The state board of health shall investigate by themselves or by agents appointed
by them, the subject of the correct method of drainage and sewerage of the cities and towns
of the Commonwealth, especially with regard to the pollution of rivers, estuaries and ponds
by such drainage or sewerage, and to devise and report a system or method by which said
cities or towns may be properly drained, and said rivers, estuaries and ponds may be protected
against pollution, so far as possible, all with the view to the preservation of the health of the
inhabitants of this Commonwealth, and the securing to the several cities and towns thereof
a proper system of drainage and sewerage, without injury to the rights and health of others;
also, to report how far said sewage may be utilized and disposed of . . . (Section 1,
Chapter 192).

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HISTORY.

Interest in the question of stream pollution in Massachusetts was very probably first aroused by the agitation of this question in England, and the first studies of the general condition of Massachusetts streams were made by the State Board of Health in the early 70's. Apparently the first legislation of importance relative to a study of the question of the condition of streams was enacted by the General Court in 1875. The important portions of this act are as follows:

. . . The state board of health shall investigate by themselves or by agents appointed by them, the subject of the correct method of drainage and sewerage of the cities and towns of the Commonwealth, especially with regard to the pollution of rivers, estuaries and ponds by such drainage or sewerage, and to devise and report a system or method by which said cities or towns may be properly drained, and said rivers, estuaries and ponds may be protected against pollution, so far as possible, all with the view to the preservation of the health of the inhabitants of this Commonwealth, and the securing to the several cities and towns thereof a proper system of drainage and sewerage, without injury to the rights and health of others; also, to report how far said sewage may be utilized and disposed of . . . (Section 1, Chapter 192).

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In its report, published in 1876, upon the question committed to it by the above legislation, the board finds that no control over the streams was exercised at that time by anyone, all of the waters being left to the ordinary rules of common law.

The following is an extract from the conclusions expressed in this report concerning the matter of stream pollution:

. . . Any defence of their waters against impurities which so conveniently flow into them from the settlements and works on their banks has thus far been merely nominal; that is, the law can be used to prevent a nuisance from continuing to be poured into the river, but it is not used because the process is too slow, cumbersome and expensive. . . .

As a result of the investigation, the board made certain recommendations, of which the following are the more important:

1. That no city or town shall be allowed to discharge sewage into any water course or pond without first purifying it according to the best process at present known and which consists in irrigation, provided that this regulation does not apply to the discharge of sewers already built—unless water supplies be thereby polluted; provided also that such intended discharge can be shown to be at such point or points that no annoyance will arise from it.

2. That no sewage of any kind, whether purified or not, be allowed to enter any pond or stream used for domestic purposes.

5. That steps should be taken by special legislation based upon investigations and recommendations of experts to meet cases of serious annoyance arising from defective arrangements for the disposal of sewage.

6. That irrigation be conducted at first experimentally at those places where some process of purification of sewage is necessary and that cities and towns be authorized by law to take such lands as may be necessary for that purpose.

Finally, the Board feel that in the present state of our knowledge, sweeping laws for the general and immediate purification of all of our streams would be hardly justifiable and that they are not called for by the present condition of our rivers.

Following the report of 1876, the question of the prevention of the pollution of certain rivers rapidly became a most pressing one and special reports upon the Blackstone River and investigations of other streams were made from time to time until 1884. In the latter year a statute was enacted creating a special commission, afterward known as the Massachusetts Drainage Commission, to consider and report upon a general system of drainage for the relief of the valleys of the Mystic, Blackstone and Charles Rivers and for the protection of public water supplies within the basins of said rivers. This commission was also directed to consider the various methods of sewage disposal and the application of such methods in preventing pollution of the streams of these valleys, etc.

The commission considered the subject very thoroughly and in 1886 made a comprehensive report upon the whole question of the control of inland waters and the prevention of the pollution of streams.

This commission recommended the appointment of a board to have general oversight and care of the inland waters of the State, with power to

advise cities, towns, manufacturers and others as to the disposal of their sewage and wastes with the view of the protection of the public interest. Concerning the duties and powers of the proposed board, the commission advised in part as follows:

Let these guardians of inland waters be charged to acquaint themselves with the actual condition of all waters within the state as respects their pollution or purity, and to inform themselves particularly as to the relation which that condition bears to the health and well-being of any part of the people of the commonwealth. Let them do away, as far as possible, with all remediable pollution, and use every means in their power to prevent further vitiation. Let them make it their business to advise and assist cities or towns desiring a supply of water or a system of sewerage. They shall put themselves at the disposal of manufacturers and others using rivers, streams or ponds, or in any way misusing them, to suggest the best means of minimizing the amount of dirt in their effluent, and to experiment on methods of reducing or avoiding pollution. They shall warn the persistent violator of all reasonable regulation in the management of water, of the consequences of his acts. In a word, it shall be their especial function to guard the public interest and the public health in its relation with water, whether pure or defiled with the ultimate hope, which must never be abandoned, that sooner or later ways may be found to redeem and preserve all the waters of the state. We propose to clothe the board with no other power than the power to examine, advise and report, except in cases of violation of the statutes. Such cases, if persisted in after notice, are to be referred to the attorney general for action. Other than this, its decisions must look for their sanction to their own intrinsic sense and soundness. Its last protest against wilful and obstinate defilement will be to the general court. To that tribunal it shall report all the facts, leaving to its supreme discretion the final disposition of such offenders. If such a board be able to commend itself by its conduct to the approval of the great court of public opinion, it will have no difficulty, we think, in materially reducing the disorders and abuses which are threatening to give great trouble in the future if not speedily checked. If, however, we err in this expectation, and more drastic measures prove indispensable, the mandate of the state can always be invoked to reinforce its advice.

The Legislature of 1886, acting on the advice of the Massachusetts Drainage Commission, passed a law embodying the conclusions of that commission and committed its enforcement to the State Board of Health. Two years later, the law was amended by providing that all petitions to the legislature for authority to introduce systems of water supply, drainage or sewerage should be accompanied by the advice and recommendation of the State Board of Health thereon. Most important among the provisions of this law was the authority to conduct experiments upon the purification of sewage and manufacturing waste.

It was thus made practicable for the board through its own investigations and experiments to obtain reliable information as to the applicability of methods of water and sewage purification to the conditions found in Massachusetts and to give definite and practical advice as to the best methods available for solving the problems presented. With the continued operation of the experiment station, which has been maintained since this law was first put into operation, it has been practicable to study thoroughly all questions relating to the purification of water, sewage and manufacturing waste and develop new methods, and frequently to anticipate new prob-

lems requiring special methods of treatment. The board was thus enabled to advise with authority as to practicable and available methods for the purification of the sewage and waste by which the streams were becoming defiled and, taken in connection with the results of studies of the effect of the discharge of sewage and manufacturing waste upon streams under various conditions, it was possible to regulate their use as places of sewage disposal with due regard to the public health and the interests of all concerned in the condition of the rivers of the State.

The effect of this law was to provide that no sewage should be disposed of in the future from any city, town, or village, until the plans of the system and method of disposal had been passed upon by the State Board of Health. There was no penalty for failure to follow the advice and recommendations of the board, and in the earlier years works were built in one or two cases which did not conform to the board's recommendations; but since the legislature, very soon after the passage of the law, began the practice of inserting in practically all special acts relating to sewerage a proviso requiring the approval of the plans by the State Board of Health, the recommendations of the board came to be more closely followed.

The law of 1886, as subsequently amended in 1888, was supplemented in 1902 to the extent of requiring an annual examination and report to the legislature by the State Board of Health on the condition of all main outlets of sewage and drainage in the cities and towns of the Commonwealth and the effect of sewage disposal.

In later years, as a result of the examination of sewer outlets under this law, it was found that sewage disposal works in some cases were not operating satisfactorily, either from lack of sufficient capacity or of proper care, or on account of the introduction of matters into the sewers which interfered with the operation of the disposal works, and in response to recommendations, authority was granted by a statute of 1909 to regulate the character of waste liquors discharging into the sewers of cities and towns having disposal works and to require the enlargement or efficient maintenance of such works where such improvements might be necessary.

The general legislation relative to the prevention of the pollution of streams in Massachusetts is comprised substantially in the laws thus far mentioned. These laws do not apply to the Connecticut River—the largest stream in the state—and were not applicable to the Merrimack River until a law was passed in 1909 amending the statutes relative to the prevention of the pollution of streams as to make them apply in the case of the Merrimack River so far as the discharge of sewage into this stream was concerned. Each of these rivers receives considerable sewage pollution before entering the state, and this fact was, doubtless, of influence in causing them to be excepted from the provisions of law applied to other rivers.

RESULTS ACCOMPLISHED UNDER THE GENERAL LAWS RELATING TO THE PREVENTION OF THE POLLUTION OF STREAMS.

At the time of the passage of the act of 1886, as nearly as can now be determined, sewerage systems had been provided in twenty-eight cities and towns, which served large sections of the more populous areas in those municipalities. There were also partial systems of sewers in many other cities and towns. In most of the older and larger municipalities drains had been constructed at an early time for the removal of surface water and ground drainage and came later to be used for the removal of sink drainage and other sewage. These drains have been superseded and their use discontinued where modern systems of sewers have been introduced, but such drains are used even at the present day in many of the smaller towns and villages. In the earlier times they were usually constructed of wood or stone, but more recently earthen pipe has usually been employed. They are built in most cases by private parties, often without manholes, and it is usually impracticable to find a record of the location of the sewer or the number of connections therewith.

The modern sewerage system was first introduced from England, having been copied largely from the sewers of London, where both sewage and rain water were being removed in the same channels, but when adapted to a region like New England with a much higher rainfall, it often happened that very large sewers were required to convey the sewage to a proper outlet, whereas for the disposal of surface water and ground drainage alone, shorter and consequently smaller channels would have been adequate and satisfactory.

These conditions led to the development of the separate system of sewerage, the advantages of which had become evident to sanitary and hydraulic engineers by the time the first laws relating to the prevention of the pollution of streams were enacted in Massachusetts, but these advantages were not so obvious to the members of municipal governments, and in some places it was many years before city and town governments generally could be convinced of the disadvantages of the continued extension of combined systems of sewers, especially in those places where the treatment or purification of the sewage was likely to become necessary. In consequence, combined systems of sewers are still the rule in the cities and large towns in Massachusetts, but are not found in smaller places where systems have been introduced in more recent years.

When combined systems are in use, it is usually impracticable, when purification becomes necessary, to deal with the entire quantity of sewage and storm water discharged from the sewers in many of the cities and towns in the State, since the complete prevention of the discharge of sewage into a stream in such cases requires either the reconstruction of practically the

entire sewerage system in order to reduce within practical limits the quantity of sewage to be treated or else an excessive outlay for the construction and operation of disposal works. The cost of either plan is in most cases prohibitive unless extended over a considerable period of years.

As a practical matter, however, the attempt either to treat all of the sewage and storm water in such cases or to effect promptly the separation of the systems is usually unnecessary. There is no doubt that a stream or river of considerable size may be used as a place of disposal for a considerable quantity of sewage without appreciable harm, and in any case it is impracticable to prevent more or less pollution of the streams in a thickly populated state like Massachusetts, even with the most complete and efficient systems of sewerage, drainage and sewage disposal thus far devised. Especially is this true of a river basin containing large urban populations, where much pollution will inevitably reach the streams, even though efficient sewerage and sewage-disposal systems are in operation in all urban districts.

Under these circumstances the usual practice has been followed, that is, in cases where the sewage of a combined system of sewers requires removal or further treatment, the dry-weather flow of sewage only is cared for, including an allowance for small rains and thaws, allowing the excess of flow at times of heavier rains to continue to discharge as before. As necessity arises, the separation of the systems of sewers is effected gradually so that eventually, if necessary, all of the sewage can be treated and the pollution of the stream prevented. The separation of sewage from storm water is already being effected in large areas of the city of Boston and other parts of the Metropolitan District, as well as in several other cities and towns.

Next to a wholesome and adequate public water supply the most important factor in the improvement of the sanitary condition of thickly settled communities is an adequate and effective system of sewerage and drainage which shall remove promptly all domestic sewage and other foul wastes from the neighborhood of dwelling houses, carry off the surface water and thoroughly drain the land, and, in carrying out the laws relating to the prevention of the pollution of streams in Massachusetts, every effort has been made to promote as rapid an extension as possible of the benefits of sewerage and drainage in thickly populated districts and at the same time to maintain the streams in a condition which shall not be objectionable or injurious to the public health by reason of sewage pollution.

In view of these considerations—viz., the impossibility of preventing all pollution of a river in a more or less thickly populated valley, the natural capacity of a stream to absorb a certain amount of pollution, often without injury to the health or other interest of those dwelling farther down the valley, and the great importance of sewerage and drainage in densely populated communities—it has not been the invariable rule to require the

purification of the sewage upon the installation of a new system in a city, town or village, but to consider carefully the conditions in each case presented, including the financial resources of the community, and to adopt the course which seemed best under all the circumstances. In consequence, whenever conditions have been found in which the admission of sewage to a stream is permissible, such a method of disposal has been advised, usually for a definite period, but always with the limitation that the sewage shall be removed from the river and treated whenever, in the opinion of the Board, such a course becomes necessary.

From the time of the passage of the act of 1886 to the end of 1912, the total number of cities and towns having systems of sewers had increased from twenty-eight to 104. Of that number, twenty-two cities and towns are included in the north and south metropolitan sewerage systems, the sewage from which is discharged into the sea at two points in the outer part of Boston Harbor; fifteen others, including the city of Boston, also discharge their sewage into the sea at various points along the coast, making a total of thirty-seven cities and towns in the state having sewer outlets into the sea. The remaining sixty-seven cities and towns discharge their sewage in all cases into inland waters; of that number, thirty-two, or nearly one half, maintain purification works for the treatment of all or a part of the sewage before it enters the stream, leaving thirty-five cities and towns which at the present time discharge their sewage untreated into inland waters. Of this number, sixteen dispose of their sewage into the Connecticut and Merrimack Rivers, the former of which is excluded from the laws relating to the pollution of streams and the latter of which was also excluded until 1909. Of the nineteen cities and towns which at present discharge sewage into inland streams other than the Connecticut and Merrimack Rivers, about half were already provided with sewerage systems at the time of the passage of the act of 1886. The municipalities which have been authorized to discharge sewage temporarily without treatment into inland waters consist for the most part of comparatively small towns. In these cases the board has advised the discharge of untreated sewage directly into the river for a limited period, usually specified, but such disposal of the sewage is to cease at an earlier time if required by the board. In the cases which have arisen where such permission has been granted and subsequently terminated, no serious difficulty has thus far been experienced in securing compliance with the conditions specified.

While the number of cities and towns discharging sewage into inland rivers, other than the Connecticut and Merrimack, is somewhat greater than when the work of the board was first begun, the population of these places is for the most part small, the towns are very widely scattered and the condition of the river in their neighborhood and below is subject to regular and careful examination, in order that when the conditions appear

to require treatment of a part or all of the sewage the necessary works can be provided in sufficient season.

SOURCES OF POLLUTION NOT AFFECTED BY THE GENERAL LEGISLATION RELATING TO THE PREVENTION OF THE POLLUTION OF STREAMS.

The effect of the application of the legislation thus far considered to the rivers of the state has been to arrest the increase in the pollution of streams and, to some extent, to recover ground lost in the years before the law was enacted, but the law of 1886 was not retroactive, and cities and towns which had already constructed sewerage systems discharging into the rivers of the state were not affected by that law. In a few of these cities purification works were installed at a later time or the sewage removed to some suitable outlet other than in the streams, but in most cases the discharge of crude sewage directly into the rivers by these cities and towns has been continued to the present time.

In some of these cases the disposal of sewage by this method has not thus far created notably objectionable conditions, but in a number of cases where the conditions have become seriously objectionable the board has endeavored to induce the city or town responsible for these conditions to discontinue the pollution of the stream after it became evident that such pollution was likely to be objectionable, and in a few cases the work has been taken up and carried out by the town without further action. A notable instance of this is the cleaning up of the Ten Mile River in the southeastern part of the state which had become badly polluted by the sewage from Attleboro and North Attleboro, towns which have an aggregate population of about 25,000. Acting under the recommendations of the board, and without being required to do so by law, these towns have installed works adequate for the complete purification of all of their sewage.

In other cases where no action could be secured on the part of the municipality responsible for the objectionable pollution of a river, the matter has been reported to the legislature and an effort made to secure the necessary legislation to require the treatment of the sewage, but very little success has attended these efforts.

The most notable result thus far secured in a recent attempt of this kind was a report of the drainage committee of the legislature that in its opinion the city in question should do something to relieve the river of the pollution caused by its sewage. Even this slight notice on the part of the legislature appears, however, to have had sufficient force to secure the construction of sewers and sewage disposal works by that city.

There still remain a few cases where the objectionable pollution of a stream is caused by the discharge from sewerage systems which were in existence before the passage of the law of 1886, yet no action has thus far been taken by the legislature to supply authority to prevent these pollu-

tions. These inequalities in the law have resulted in some cases in producing curious anomalies in the treatment of the stream pollution question in different valleys. One of the most notable of these is the situation in the Housatonic Valley in which sewerage systems have been installed in one city and five towns. Three of these municipalities have provided themselves with purification works, under the requirements of the State Board of Health, but in two of the other three, sewerage systems were in existence previous to the passage of the law, while in the third the construction of a sewerage system was authorized by the legislature without regard to the law of 1886, and these three towns continue to discharge sewage untreated into the stream. There has been a marked increase in the pollution of the river in this valley and an agitation has arisen that all of the towns shall be required to remove their sewage from the stream. It is not improbable that special legislation may be sought for the improvement of this river similar to that which has been enacted in the case of certain other rivers, of which mention will later be made.

FURTHER LEGISLATION RELATING TO THE PREVENTION OF THE POLLUTION OF STREAMS.

While the general laws already described are clear and well-defined in matters relating to the pollution of streams by cities and towns, the powers delegated to the State Board of Health for the purpose of preventing the pollution of streams by manufacturing waste were less specific, though they require the board to consult with manufacturers as to the purification of their wastes and authorize experiments to ascertain the practicable methods of treatment.

In certain of the rivers, manufacturing wastes rapidly came to be the chief causes of objectionable pollution, and this condition has led to the enactment of special legislation on the part of the state directed to the improvement of certain specific streams which had become badly polluted and were not adequately protected by the general laws. The first of these laws relates to the prevention of the pollution of the Neponset River, a small stream in the easterly part of the state which flows into Boston Harbor at the southerly boundary of the city of Boston. The condition of the Neponset River had been the subject of investigation by the State Board of Health in 1875 and again ten years later by the Massachusetts Drainage Commission, which had reported to the legislature plans for preventing the objectionable pollution of this stream. No action was taken by the legislature upon these recommendations, however, and the condition of the river was again the subject of investigation by the State Board of Health in 1890 and 1891, the results of which were also presented to the legislature.

Four years later the legislature directed a thorough investigation of the river and the condition of the Fowl Meadows, so called, an area of drowned

lands covering several square miles in the central portion of the watershed through which lay the course of the stream. This order was as follows:

RESOLVED, That the state board of health be directed to investigate the sanitary condition of the meadows on the Neponset river and the beds, shores and waters of said river in the towns of Canton, Sharon, Norwood, Dedham, Milton and Hyde Park, and report whether their conditions are dangerous or injurious to the public health by reason of stagnant water or refuse from manufactories, or other causes. If said board shall find that the condition of the meadows or of the beds, shores or waters is dangerous or injurious to the public health, they shall recommend some plan for improving their sanitary condition and for the removal of any nuisance therefrom, and report the same to the next general court. The board may expend a sum not exceeding three thousand dollars in carrying out the provisions of this resolve.

Under this legislation, the river and the Fowl Meadows were examined and their condition described in a report to the Legislature in 1897. The causes of the pollution of the river in this case were the wastes from a large number of manufacturing establishments, chiefly paper mills, tanneries, woolen mills, etc., together with a small amount of sewage from town sewers and drains and from factories and dwellings.

In its report the board recommended the following measures for the removal of the conditions which were found to be injurious to health in the Neponset Valley:

First.—Such additional legislation as will prevent the entrance into this stream of sewage and manufacturing wastes which have not been satisfactorily purified.

Second.—The permanent removal of the flashboards of the dam of the Mattapan Mills, the enlargement of the cross-section of the river at points indicated on Plan No. 3, together with a deepening and reconstruction of the channel at such places as may be found necessary for making a channel of such width and grade as will prevent the flooding of the meadows during the times of high flows in late spring and summer.

The board also made the following further general recommendations relative to more effective measures for preventing the pollution of streams:

. . . It is our opinion that all reasonable efforts have been exhausted in the attempt to do away with the remediable pollution of these waters, and that the time has come when the State must take more effective measures for the prevention of the pollution of the streams not now used as sources of domestic water supply, but still capable of injurious effect upon the public health.

These recommendations of the board, supported by petitions from the inhabitants of the valley, were considered by several successive legislatures and in 1902, five years after the report was presented, an act was passed authorizing and directing the board to prevent the pollution of these waters, but this act contained certain provisions which rendered it practically inoperative and no material progress was secured under it in preventing the pollution of the river. In the meantime, the condition of the stream grew worse and finally, in 1906, nine years after the plans for improving the river had been presented to the legislature, and specific recommendations

made for its improvement, the act of 1902 was amended and reduced to a more efficient form.

Under the interpretation of these laws by the law department of the Commonwealth, the board first gave notice to the cities, towns and others discharging pollution into the streams to discontinue such discharge unless the best practicable and reasonably available means were taken to render such waste or refuse harmless. The board then, under the provision of the act requiring it to consult with and advise the owners of factories either at their request or of its own motion as to the best practicable and reasonably available means of rendering their waste and refuse harmless, examined carefully all of the various wastes from each of the factories along the river and its tributaries and, where necessary, instituted experiments for the purpose of determining the best practicable method of purifying these wastes to such an extent that they would not produce objectionable conditions in the river. When the work was completed, the proprietor of each factory was advised as to methods which would render harmless the wastes therefrom and required to carry out the provisions of law.

The problem of purifying factory wastes, such as are found in this valley, is a very difficult one under the circumstances existing there. In some cases the factories are located in the midst of a rather dense population and areas suitable for disposal works cannot be secured in the neighborhood of the factory. In other cases, the construction of disposal works for the purification of such waste in the midst of a thickly-settled district would create a nuisance and other methods of disposal are necessary in such cases. Where a sewerage system exists in a city or town, it is practicable in some cases to admit such wastes to the sewers, but some of these wastes are of such a character as to interfere with the operation of the sewers or of sewage disposal works. Many of the works produce great quantities of waste, and as some of the works use, in dry seasons, nearly, if not quite, the whole flow of the river in their processes, it is necessary that the waste be treated in the neighborhood of the factory, in order that the water may be returned immediately to the river for the use of mills lower down the stream.

The results secured under these laws have not yet been such as to produce any marked improvement in the condition of the river which is offensive to sight and smell, in the drier part of the year throughout a large part of its course. Purification works have been begun at nearly all of the mills, and at a few of the mills all of the objectionable wastes are treated for the removal of objectionable matters, usually by sedimentation with subsequent filtration, or straining through sand, gravel, cinders or coke.

A large number of cases of pollution were long ago referred to the attorney-general, and in most of them action is still pending. Sewers or drains carrying sewage were found in two towns and these also were referred to the law department. In one of these cases the court postponed issuing a

decree in order to give the towns an opportunity to construct works and this opportunity was availed of so that no further action was necessary in that case. The other is still pending. A case against a manufacturer set down for a hearing early in the present year has been postponed to give the manufacturer further opportunity to make adequate provision for the purification of his waste liquors, which are large in amount and very objectionable. With the exception of one town, practically all domestic sewage has been removed from the river, and a manufacturing concern which recently began the discharge of sewage into the stream has been convicted in the courts. On account of the limitations of the act and the slow and cautious proceedings of the courts, the work of securing the necessary improvement of this river is slow and difficult, but by continued and persistent effort it is probable that an improvement in the condition of the river can be effected.

The other specific recommendation of the board—relating to the necessity of draining effectually the wet lands known as the Fowl Meadows—was considered by many successive legislatures, and finally in 1911 an act passed providing for carrying out the recommendations of the board and the necessary amount of money was appropriated for the purpose. This work will probably be completed in 1914.

SPECIAL LAWS RELATING TO OTHER STREAMS.

Some time after the passage of the special law relating to the Neponset River, a similar law was passed by the legislature to provide for the improvement of the Aberjona River, a small stream lying in the northern part of the metropolitan area adjacent to Boston. The towns in the valley of this stream are all provided with extensive sewerage systems connected with the north Metropolitan sewerage works and all of the wastes are disposed of finally by discharging them through the Metropolitan system. The streams in this watershed are very small, however, and when the flow is low in summer they become at times seriously polluted by drainage from large quantities of tannery and other wastes deposited in their valleys and by leakage through the floors of tanneries and other establishments, which—instead of being discharged into the sewers—is allowed to flow into the streams. An enlargement of the sewerage system in this region is now being carried out, and it will probably not be difficult to prevent the pollution of these small water courses in the future.

A special law has also been enacted for the protection of that portion of the Charles River lying within the Metropolitan district, the act in this case also being similar to the Neponset River act, except that the State Board of Health is not authorized to proceed except upon petition from certain of the municipal authorities in the valley. The sewers are available in this valley also for the removal of the manufacturing waste in nearly all

cases, and the only action required thus far has been a notice to certain manufacturers as to the necessity for caring for their wastes in such a way as not to pollute the river.

OTHER SPECIAL LAWS.

The only other stream which the legislature has thus far sought to improve by a specific law is the Blackstone River. The legislature of 1886, which passed the first important law relative to the prevention of the pollution of streams, adopted also a special act relative to the prevention of the pollution of the Blackstone River, an important clause of which is the following:

. . . The city of Worcester shall, without being limited to any particular system, within four years after the passage of this act, remove from its sewage before it is discharged into the Blackstone River the offensive and polluting properties and substances therein, so that after its discharge into said river, either directly or through its tributaries, it shall not create a nuisance or endanger the public health. . . .

Action was taken in the courts by one of the towns in the valley below the city of Worcester many years ago to secure an improvement in the condition of the river which was at that time grossly polluted by the sewage of that city. The matter remained in the courts for many years and in the meantime the city of Worcester constructed various and extensive works for the purification of its sewage which included a chemical precipitation works and an area of 73 acres of sand filter beds, by which a part of the sewage is filtered and the remainder subjected to chemical precipitation.

The Blackstone River in more recent years has become seriously polluted in other parts of its course by manufacturing waste and by the drains in villages which have come to be used as sewers. Its condition is very objectionable and some further legislation is likely to be required before a material improvement can be effected.

Very important among the special laws relating to streams are those which in specific cases give authority to cities and towns to take and control the natural streams within their limits. Under such authority it is practicable for a city or town to deepen, straighten and improve the local water courses and maintain them in satisfactory condition, a difficult problem in thickly settled regions unless the channels are covered.

LOCAL LAWS RELATIVE TO STREAM POLLUTION.

Many of the serious pollutions of the smaller streams and the local nuisances caused thereby occur within the limits of a single city or town and in such cases the powers of the local health authorities under Massachusetts laws are ample for the prevention of nuisances. In case of the neglect or refusal of a local board of health to take proper action relative to a nuisance, an appeal may be had to the county commissioners, but no appeal to the State Board of Health has been provided in such cases. Either party can,

however, request the advice of the State Board of Health as to proposed plans or measures for the removal of the objectionable conditions complained of, and confidence in the efficacy and reasonableness of the recommendations of the board has commonly secured the action necessary to relieve the nuisance. The right of appeal to the county commissioners is rarely used.

ACTIONS AT LAW FOR THE PREVENTION OF THE POLLUTION OF STREAMS.

In a number of instances, especially where a manufacturer considers that his rights are infringed by the pollution of a river by a town or factory discharging waste into the stream above him, action has been brought in the courts to secure an injunction against the pollution of the river, and usually damages for the injury alleged to have been sustained.

Several such suits have been successful, and in discussing the question of stream pollution in one of its decisions, the Supreme Court made the following observations:

The right to use the stream to carry away mere waste matter in a reasonable manner and to a reasonable extent is not so to be extended as to include a right to discharge into the stream noxious and deleterious matter to such an extent as sensibly and materially to foul the water and destroy its purity and fitness to be used by others.

It is true of course that there is in any large body of water a purifying principle which will, either by ordinary sedimentary deposit or by chemical change, obviate the evil effects which otherwise would arise from the deposit therein of some limited amount of noxious matter. Accordingly it is not for every small deposit of such matter that the law will give a remedy.

. . . There doubtless must be a material and sensible deterioration of the quality of the water. . . .

THE MERRIMACK AND CONNECTICUT RIVERS.

In all of the general laws relating to the prevention of the pollution of streams as originally enacted and as subsequently amended or codified, a special provision has been inserted that the requirements of the act were not to apply to the Merrimack and Connecticut Rivers, nor to so much of the Concord River as lies within the limits of the city of Lowell.

The Merrimack and Connecticut Rivers are the largest streams in the state and each of them receives much pollution from beyond its borders. In each case, also, large quantities of sewage were being discharged into the stream by the cities and towns along its banks in the course of its flow through the state, previous to the time when the laws relating to the prevention of the pollution of streams were first enacted.

The objectionable conditions of the Merrimack River arise almost entirely from two principal causes; one, the discharge into the river at Lawrence of an enormous quantity of waste from the process of wool scouring, and, two, the fouling of the banks of the river by sewage from the sewer

outlets of the large cities located along its banks, which discharge in most cases at the edge of the river bank at high water, whence the sewage flows across the exposed bottom of the stream in the summer season to the low-water channel, greatly fouling the banks and bed of the river, which are offensive at numerous places in these cities.

These conditions can be remedied without difficulty by the cities themselves if they choose to do so. Notwithstanding that the matter has been called to their attention frequently, they have failed thus far to provide proper outlets for their sewage. The new sewer outlets in these rivers, however, have been carried well out into the low-water channel and the offensive pollution of the banks of the river in these few cases avoided.

The Connecticut River has a drainage area nearly twice as great as the Merrimack where it passes out of Massachusetts, and the urban population of the Connecticut valley is much smaller than that of the Merrimack. In consequence, the dilution of the sewage is much greater. While much manufacturing waste is discharged into the Connecticut River, both within the state and in its upper waters before reaching the state, the condition of the bed, banks and waters of the river has not become objectionable at any point except in the neighborhood of some of the sewer outlets of the principal cities and towns, where the conditions are much the same as those already described in the cities of the Merrimack valley.

Much improvement has been made in recent years along the Connecticut River, many of the principal sewer outlets have been extended a distance of 200 to 300 feet into the stream, and the number of objectionable sewer outlets is few compared with the Merrimack valley. The sewers in the principal cities in the valleys of the Connecticut and Merrimack Rivers are nearly all constructed upon the combined plan and the complete removal of sewage from these rivers would require the introduction of separate systems of sewers in the greater part of nearly all of these cities. Circumstances have not become such as to require the treatment of the sewage of the cities and towns bordering these rivers as yet, though the problem of dealing with the sewage of cities along the Merrimack River may become a serious matter at no distant time.

Both of these rivers receive much pollution from manufacturing wastes in addition to the sewage, and in later years the condition of the Merrimack River has become seriously objectionable below the city of Lawrence and special legislation was secured in 1909 directing the State Board of Health to investigate and report upon the sanitary condition of the bed, banks and waters of this river, to ascertain whether it was in a condition injurious or dangerous to the public health or likely to become so, and, if so, to recommend plans for the removal of objectionable conditions. The board presented a report upon the matter to the legislature of 1909, and upon its recommendation this river was subjected to the same regulation as the

other streams of the state under the laws relating to the prevention of the pollution of streams.

Subsequently, under the further requirement of the legislature, the board continued the examination of this river and presented to the legislature of 1913 a detailed statement of the sources of pollution, together with plans for removing the most important of the pollutions of the stream and making such changes in the sewer outlets in the cities and towns along its banks as would prevent further objectionable conditions. This report was presented to the legislature of 1913 and referred to the committee on public health, which committee promptly reported no legislation necessary.

SUMMARY.

In so far as the rivers of the state in general are concerned, the powers contained in the law of 1886, as amended in 1888, and supplemented later by the acts relating to sewer outlets and to the maintenance of sewage purification works, are the only general powers which have thus far been delegated by the legislature to the State Board of Health for the prevention of the pollution of streams and inland waters.

These laws are not mandatory except that they require the submission of plans to the State Board of Health for its advice, and no penalty is provided for neglect to observe them or carry out the recommendations that the board may make. Nevertheless, the recommendations of the board have almost invariably been followed, and the requirements of these laws very rarely evaded. The success that has attended the execution of these laws is attributed very largely to the course followed in carrying out their requirements. The board employed, from the beginning, physicians, engineers, chemists and other experts trained in this work and, aided by the results of thorough scientific investigations at Lawrence, was enabled to give reliable advice on questions relating to the purification of sewage and manufacturing waste and the measures necessary to prevent the objectionable pollution of streams. The reasonableness of its recommendations in the solution of practical problems quickly commended itself to the public and, taken as a whole, these acts have operated effectually and satisfactorily, with little friction, in the prevention of the objectionable pollution of inland waters in Massachusetts. Had they been in force at an earlier time and been applied to all of the inland waters of the State, the objectionable pollution of the streams by the sewage of cities and towns would to a large extent have been prevented.

The results of efforts to redeem the rivers which had already become badly polluted before the passage of these acts and to remove objectionable pollution not reached by those laws has been less satisfactory. In the cases in which the Legislature has been urged to interfere, action has often been avoided and in the most extreme cases where tardy action has finally been

taken, the limitations of the law and the cautious action of the courts have made progress under such laws extremely slow.

Nevertheless, progress is being made in the improvement of polluted rivers even under these circumstances, and there appears to be a growing recognition on the part of the authorities of cities and towns and the owners of factories of the demand that rivers shall not be used indiscriminately for the removal of sewage and foul waste to such an extent as to make them objectionable. But it is difficult to secure adequate laws for the relief of rivers already excessively polluted by the sewage of those cities and towns which will not voluntarily undertake the necessary improvement, unless there is evidence that the conditions are such as to be dangerous to the public health.

While at the present time there seems to be no danger that the desire for cleaner streams be carried too far or that experienced health authorities will attempt the application of impracticable standards to streams not used as sources of water supply, it is easily possible to go to extremes in this matter and, by attempting to apply unreasonable standards, to produce a reaction unfavorable to continued progress in the work of securing and maintaining cleaner streams.

It is important to recognize always the fact that it is impracticable to keep all pollution out of streams draining populous territories, especially regions containing numerous industries of the kinds which foul large quantities of water in their processes. The effluents from purification works alone, no matter how well conducted they may be, will inevitably cause some pollution of the streams, and the washings from streets, gardens, yards, factory grounds, etc., will contribute a further and by no means an insignificant quantity, as experience has shown in the valleys of rivers of considerable size, where thorough sewerage has made possible the complete removal of all sewage and objectionable manufacturing waste. Nevertheless, in some cases such streams are being maintained in such condition that they are not objectionable either to sight or smell. Their waters show upon analysis a much greater degree of pollution than those of rivers draining strictly agricultural regions, however populous, just as the waters of the latter are inferior in purity to those of the mountain streams, but their condition is unobjectionable for any reasonable present purpose, and they are not a menace to the public health.

In the efforts to prevent the pollution of streams and to do away with remediable pollution in cases where it has become objectionable, the results sought must be those which will secure the most effective sanitary improvement practicable for the inhabitants of the region affected, and the circumstances in each case must determine the course to be followed in regulating the use of the streams and inland waters as the ultimate places of disposal for sewage and manufacturing wastes.

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